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File: JPAB

Sep 6, 1994

PUB-NO: JP406247109A

DOCUMENT-IDENTIFIER: JP 06247109 A

TITLE: PNEUMATIC TIRE

PUBN-DATE: September 6, 1994

INVENTOR-INFORMATION:

NAME

HIMURO, YASUO

COUNTRY

ASSIGNEE-INFORMATION:

NAME

BRIDGESTONE CORP

COUNTRY

APPL-NO: JP05033442

APPL-DATE: February 23, 1993

INT-CL (IPC): B60C 11/04

ABSTRACT:

PURPOSE: To secure a high wet characteristics and to realize a low noise by providing dead-end terminals near the tread center and the width ends of inclined main grooves having a specific length and inclination, and combining narrow branch auxiliary grooves extending to the side wall side to the dead-end terminals.

CONSTITUTION: Dead-end terminals 2a and 2b are provided in the central areas and near the width ends of the treads of inclined main grooves 2 which partition the grounding land together with the width ends of the treads, and extend staggering in a slight inclination to a tire equatorial surface. And the plural main grooves 2 are made in the length and the inclination which can position both dead-end terminals 2a and 2b along the front to the rear side of the tread across the grounding length L of the tread, in the dynamic adding radius of the tire, constantly. Furthermore, along the area from the dead-end terminals 2b near the tread ends or the vicinity, crossing the dead-end terminals, to the side wall side, relatively narrow branch auxiliary grooves 3 extending on the tire equatorial surface at a gentle slope are provided at least one groove to each dead-end terminal 2b. Consequently, a high wet characteristics and a low noise can be obtained compatibly without reducing other important functions.

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L1: Entry 2 of 2

File: DWPI

Sep 6, 1994

DERWENT-ACC-NO: 1994-321881

DERWENT-WEEK: 199440

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TITLE: Pneumatic tyre of low noise and high wet performance - has inclined main grooves that have dead ends and length and angle of which are determined to make high wet performance compatible with low noise level

PATENT-ASSIGNEE:

ASSIGNEE

BRIDGESTONE CORP

CODE

BRID

PRIORITY-DATA: 1993JP-0033442 (February 23, 1993)

Search Selected**Search ALL****Clear**

PATENT-FAMILY:

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1993JP-0033442

INT-CL (IPC): B60C 11/04

ABSTRACTED-PUB-NO: JP 06247109A

BASIC-ABSTRACT:

In a pneumatic tyre having inclined main grooves that run alternately at a small angle to the tyre equator from the tread centre area to both tread edges, the inclined main groove has dead ends in the tread centre area and near the tread edges, and some of the inclined main grooves are longer than the length of the ground-contact area under dynamic load radius and have such an angle and length that both the dead ends are present in the ground-contact area.

Further, in the vicinity of either tread edge, at least one narrow branch groove runs from the dead end or near it toward the side wall section beyond the tread end, at a small angle to the tyre dia.

Negative ratio is pref. set to 0.25-0.35 to maintain sufficient wet performance. Inclined main groove is inclined at a high angle esp. in the tread centre area for good drainage. This high angle produces less impact noise at ground contact and thus does not badly affect the pattern noise.

ADVANTAGE - Pneumatic tyre can make high wet performance compatible with low noise level, without degrading other major functions.

CHOSEN-DRAWING: Dwg.0/4

TITLE-TERMS: PNEUMATIC TYRE LOW NOISE HIGH WET PERFORMANCE INCLINE MAIN GROOVE DEAD
END LENGTH ANGLE DETERMINE HIGH WET PERFORMANCE COMPATIBLE LOW NOISE LEVEL -

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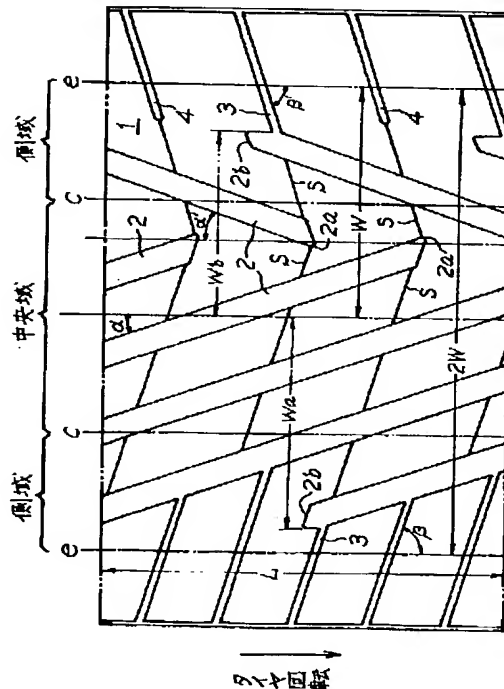
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(54)【発明の名称】 空気入りタイヤ

(57)【要約】

【目的】 空気入りタイヤにおける高いウェット性能を低ノイズの下で両立させ得るトレッドパターンを提供すること。

【構成】 タイヤの赤道面に対し浅い角度でトレッドの中央域からトレッドの幅方向の左右へ互いちがいに斜めにのびる多数の傾斜主溝を有する空気入りタイヤにして、傾斜主溝をトレッドの中央域、幅端近傍域に行止まり端を有して少なくとも2本宛がトレッドの接地長をこえてその前後に開通するものとして、トレッド幅端に近い行止まり端ないしはその近傍からサイドウォール側まで開通する緩に傾斜の分岐副溝と組合わせた溝排列になるパターンをもつ空気入りタイヤ。



【特許請求の範囲】

【請求項1】 一对のサイドウォール間にトロイド状をなしてまたがるクラウン部に路面と接するトレッドをそなえて、このトレッドは、タイヤの赤道面に対し浅い角度でトレッドの中央域からトレッド幅方向の左右へそれぞれ互いちがいに斜めに延びる多数の傾斜主溝の排列により、これら傾斜主溝とトレッドの幅端とで接地陸部を区分して成る空気入りタイヤにおいて、

傾斜主溝が、トレッドの中央域とトレッドの幅端の近傍とにそれぞれ行止まり端末をもち、かつ上記した多数の傾斜主溝のうちの複数が不斷に、タイヤの動的負荷半径の下における接地長さをこえその前後にわたって上記行止まり端末の双方を位置させ得る長さで傾きに成り、しかもトレッドの幅端付近にて傾斜主溝の上記行止まり端末ないしその近傍からトレッドの幅端を実質的にこえてサイドウォール側までの間にわたってタイヤの赤道面に対し緩い傾きをもって延びる少なくとも1本宛の比較的幅狭な分岐副溝との組合わせ排列に成ることを特徴とする空気入りタイヤ。

【請求項2】 傾斜主溝が互いに向い合ってトレッドの中央域では凸、トレッドの幅端側では凹にそれぞれ湾曲する、ゆるくうねった溝すじをもつ請求項1に記載した空気入りタイヤ。

【請求項3】 互いに隣り合う傾斜主溝が、各分岐副溝の相互間隔をほぼ等分に区分する複數本宛の分岐副溝との組合わせ排列になる請求項1又は2に記載した空気入りタイヤ。

【請求項4】 互いに隣り合う傾斜主溝における分岐副溝がそれらの相互間隔を傾斜主溝から離隔して等分に区分する付加副溝との交互排列になる請求項1、2又は3に記載した空気入りタイヤ。

【請求項5】 分岐副溝がトレッドの中央域へ向かい傾斜主溝と交差して延びる、より狭幅の細溝からなる延長部分をもつ請求項1、2、3又は4に記載した空気入りタイヤ。

【請求項6】 分岐副溝がその延長部も含めて、トレッドの中央域から幅端に行く程より小さいピッチ配列になる請求項5に記載した空気入りタイヤ。

【発明の詳細な説明】

【0001】

【産業上の利用分野】高運動性能タイヤ、すなわち走行性能が最高水準に達するまで向上した高級高性能車兩への装着供用に適合するように改善された空気入りタイヤにおいて、主要機能を犠牲にせずして高いウェット性能とパターンノイズ低減を両立するトレッドパターンについての抜本的構想を具体化した空気入りタイヤを提案しようとするものである。

【0002】

【従来の技術】ウェット性能の改善とパターンノイズ低減を両立するためには、例えば特開平4-1920号公

報に示されているように、ストレート主溝と方向性の傾斜溝を組合わせたパターンが一般的である。

【0003】またこの場合ウェット性能のうち耐ハイドロプレーニング性を良くするには、溝面積（ネガティブ）を増やすことが効果的であってもノイズは悪化することがすでに知られているとおりである。

【0004】

【発明が解決しようとする課題】通常の方向性の傾斜溝に加えて傾斜溝の傾きをタイヤの径方向に対しかなり高く、つまりタイヤの赤道面に対し浅い角度に設定したハイアングルの超傾斜溝を組合わせることにより排水性が良くなることが発明者らの実験検討の結果知見された。

【0005】すなわち通常の方向性傾斜溝に加えて超傾斜溝を組合わせることがウェット排水の面では有利となるのであるが、しかしその組合わせの一方如何によっては十分なブロック剛性を確保するためにピッチ長さを大きく設定する必要を伴って、ピッチバリエーション効果を期待し難く、そのためノイズがやはり悪化するうれいがある。

【0006】そこで高いウェット性能を確保しつつ低ノイズ化を図る必要があり、この両立を有利に実現し得るトレッドパターンを与えることがこの発明の目的である。

【0007】

【課題を解決するための手段】本発明は、一对のサイドウォール間にトロイド状をなしてまたがるクラウン部に路面と接するトレッドをそなえて、このトレッドは、タイヤの赤道面に対し浅い角度でトレッドの中央域からトレッド幅方向の左右へそれぞれ互いちがいに斜めに延びる多数の傾斜主溝の排列により、これら傾斜主溝とトレッドの幅端とで接地陸部を区分して成る空気入りタイヤにおいて、傾斜主溝が、トレッドの中央域とトレッドの幅端の近傍とにそれぞれ行止まり端末をもち、かつ上記した多数の傾斜主溝のうちの複数が不斷に、タイヤの動的負荷半径の下における接地長さをこえその前後にわたって上記行止まり端末の双方を位置させ得る長さで傾きに成り、しかもトレッドの幅端付近にて傾斜主溝の上記行止まり端末ないしその近傍からトレッドの幅端を実質的にこえてサイドウォール側までの間にわたってタイヤの赤道面に対し緩い傾きをもって延びる少なくとも1本宛の比較的幅狭な分岐副溝との組合わせ排列に成ることを特徴とする空気入りタイヤであり、ここに、傾斜主溝が互いに向い合ってトレッドの中央域では凸、トレッドの幅端側では凹にそれぞれ湾曲する、ゆるくうねった溝すじをもつこと、互いに隣り合う傾斜主溝が、各分岐副溝の相互間隔を等分に区分する複數本宛の分岐副溝との組合わせ排列になること、互いに隣り合う傾斜主溝における分岐副溝がそれらの相互間隔を傾斜主溝から離隔してほぼ等分に区分する付加副溝との交互排列になるこ

と、そして分岐副溝がトレッドの中央域へ向かい傾斜主溝と交差して延びる、より狭幅の細溝からなる延長部分をもつことが好適である。

【0008】図1、2及び3に、この発明に基づくトレッドパターンを例示した。これらのトレッドパターンが適用される、空気入りタイヤの基本構成は、一対のサイドウォールとこれらの間でトロイド状をなしてまたがるクラウン部とを、サイドウォール部内周縁のビード部に埋設されるビードコアのまわりに巻返し固着したコードのプライからなるラジアル構造のカーカスによって補強し、またクラウン部のまわりに通常その中央円周を含む平面に対し小角度で交る、相互平行排列コードの複数層の交差積層になるベルトの配置にて、クラウン部にそなえられるトレッドを補強してなり、さらにビード部のプライ端やクラウン部のベルト端ないしはその外周に適宜補強部材が配置され得るのは、あらためていうまでもない。

【0009】各図において図中1はトレッド、2は傾斜主溝、2a、2bはその行止まり端末、3は分岐副溝、図2、3において3aは分岐副溝の延長部分であり、図1、3において4は付加副溝である。

【0010】図1及び3において傾斜主溝2は、トレッド1の中央域とトレッド1の幅端の近傍との両行止まり端2a、2b間にわたってタイヤの赤道を含む平面（タイヤ赤道面）に対し浅い角度でトレッド1の中央域からトレッド1の幅方向左右へそれぞれ互い違いをなして斜めにストレートに延びるのに対し、図2で傾斜主溝2は互いに向い合ってトレッド1の中央域で凸、トレッド1の幅端側では凹にそれぞれ湾曲するゆるくうねった溝すじカーブに沿って延びる溝形状に差異を含むが、トレッド1の全体で多数にわたる傾斜主溝2のうちの複数が不断に、タイヤの動的負荷半径の下におけるトレッド1の接地長さ（L：図1参照）をこえその前後にわたって上記行止まり端末2a及び2bの双方を位置させ得る長さで傾きになる点では共通である。

【0011】ここにトレッド1の中央域というのはトレッド1の接地幅の $1/2$ （以下“トレッド半幅”といい、Wで示す）のさらにほぼ $1/2$ をタイヤ赤道からそれぞれ左右に隔だてるトレッド円周c、c（図1参照）によって仮想的に区分される帯状領域で、その両側のトレッド1の幅端e、eに至るまでの側域とともにトレッド1を形成する。

【0012】図1、3の場合、傾斜主溝2の行止まり端末2aは、図において右側に偏った非対称排列になるが図2に示すようにタイヤ赤道面を挟む整列配置とすることができる。

【0013】傾斜主溝2は、トレッド幅端e付近の行止まり端末2bないしその近傍から、トレッド1の幅端eを実質的にこえてサイドウォール側までの間にわたり、タイヤの赤道面に対し緩い傾きをもって延びる少なくと

も1本宛、図1、3の左側では3本宛、右側では1本宛、図2では左右とも2本宛の、比較的狭幅な分岐副溝3を有し、これらの分岐副溝3は図2、3のようにトレッド1の中央域へ向かって隣接の傾斜主溝2と交差してのびるより狭幅の細溝3a、3b、3c又は3a、3b、3c及び3dよりなるような延長部分をそなえることができる。

【0014】何れの場合も、分岐副溝3は、互いに隣り合う傾斜主溝2に関して各分岐副溝3の相互間隔をほぼ等分して区分する複数本として傾斜主溝2との組合せ排列に成るを可とし、図1、3の左側で3等分、図2では左右とも2等分した事例であり、図1、2の場合、図の右側の分岐副溝3の相互間隔を2等分し傾斜主溝2から離隔する付加副溝4を排列した事例である。

【0015】上に述べたところにおいて傾斜主溝2はそのタイヤの赤道面に対する浅い傾斜角度を、 30° 以下、より好ましくは $5 \sim 20^\circ$ でトレッド1の幅方向の左右に互い違いの排列とする。なお図2の事例では、湾曲点の両側における凹凸両曲線につきそれらの長さの2等分点における各接線のタイヤの赤道面に対する交角の平均で $5 \sim 20^\circ$ となるようにすればよい。また分岐副溝3、付加副溝4は、タイヤの赤道面に対して 30° 以上の角度で、それ故トレッド1の接地長Lを貫通することのない排列とする。

【0016】傾斜主溝2、分岐副溝3と付加副溝4、及び分岐副溝3の延長部分としての細溝3a、3b、3cないしは3dは、上記の列記の順に狭い溝幅をもつものとし、具体的にいうと傾斜主溝2はトレッド1の半幅Wの $5\% \sim 15\%$ 、これに対し分岐副溝3及び付加副溝4は、傾斜主溝2の溝幅に対し $20 \sim 40\%$ の溝幅で、トレッド1が動的負荷を受けた際の接地中も閉じ合わさることのない少なくとも 2mm を下限とし、細溝3a、3b、3cないしは3dについては更に狭く、傾斜主溝2の溝幅に対し $15\% \sim 30\%$ とする。

【0017】図1、2に細線で示したように傾斜主溝2のトレッド1の中央域に位置する行止まり端2aから分岐副溝3または付加副溝4とほぼ平行してのびるサイアスをトレッド1の接地中に閉じ合わさるせまい幅（約 1mm ）で設けて傾斜主溝2間の接地陸部をトレッド1のまわりに沿って分断することがのぞましい。

【0018】上記した溝排列によるトレッド1のネガティブ比すなわち溝部総面積の、溝部総面積と陸部総面積の和に対する比は $0.25 \sim 0.35$ の範囲内とすることがのぞましく、また溝部総面積に対する傾斜主溝の合計面積の比は、 0.7 を下まわらないことが好ましい。

【0019】

【作用】

1) 本発明においては、十分なウェット性能を維持するために方向性を持つ傾斜主溝を備えてネガティブ比を $0.25 \sim 0.35$ とするのが一般的である。

【0020】2)トレッド接地面内での水の流れはトレッドの中央域ではトレッドの接線方向に対して $0^{\circ} \sim 30^{\circ}$ 前方に、トレッド側域はそれより大きい角度で側方に向う。従って、特にトレッド中央域に傾斜角がかなり小さいハイアングルの傾斜主溝を備えることがウェット排水性において効果的である。また、ハイアングルのため接地時のインパクト成分が少なくパターンノイズに対する悪影響は少ない。

【0021】3)そしてハイアングルの傾斜主溝はトレッドの中央域から側域に向かって連続して延びかつ十分な溝ボリュームを確保することにより従来のトレッド円周に沿うようなストレート主溝にかわる踏面内の排水機能を果たすことが可能となる。

【0022】4)このとき、傾斜主溝溝面積合計の、トレッド全体における溝部総面積に対する比が0.7%以上を確保することがウェット排水性において望ましい。

【0023】5)ハイアングルの傾斜主溝はトレッドの接地面内の踏み込みから蹴り出しまでにわたって連通することで十分な排水がおこなわれるため、少なくとも接地面内には不断に2本以上の傾斜主溝の存在が必要であり、その角度のままトレッドの幅端には開口せずに接地面内の排水をカバーするようにトレッドの幅端側の傾斜主溝の行止まり端末2bのタイヤ赤道面からの隔よりWaを、トレッド半幅Wの70%以上にする。

【0024】6)直進時のウェット踏面での排水に関してはハイアングルの傾斜主溝のみでほぼ十分であるが、コーナリング排水機能を、通過騒音低減のために気柱共鳴の周波数をずらす必要とともに充足するように、少なくとも接地長よりも短いピッチでハイアングルの傾斜主溝と交差するローアングル狭幅の分岐副溝及び付加副溝を設ける。

【0025】7)このとき各副溝は数が多過ぎるとインパクトチャンスが増えてパターンノイズが悪化するため、ノイズに影響の大きいトレッドの中央域は交差ピッチを大きくし幅端に行くほどピッチを細かくすることが好ましい。

【0026】8)また、隣接する陸部どうしの間隔を、*

	溝幅 (mm)	溝角度
右上向き傾斜主溝 2	11.5	18°
右上向き傾斜主溝 2	10.5	18°
分岐副溝 3	4	72°
付加副溝 4	0.7	72°

【0032】

【数2】発明パターンB (図3) : N 32.5 %

Na : 28%

Na/N=86%

※50 【表2】

*十分なブロック剛性が確保できる設定とすると、ピッチ長が伸びてバリエーション効果が得られにくいのでパターンノイズが悪化しやすく、両副溝によるインパクト成分を低減することも必要である。よって、ローアングルの狭幅分岐副溝の溝幅を細く、インパクト成分を抑えるように、ハイアングルの傾斜主溝の溝幅の20~40%の溝幅にとどめるのが良い。

【0027】9)ハイアングルの傾斜主溝は図2についてすでにのべたように略S字状に延びる曲線でも良いが傾斜主溝の長さの中央から踏み込み側ではハイアングルの重要な区域で、接地面内の水の流れに沿ってトレッドの中央域から側方に向けてゆるくカーブする流線方向が望ましい一方、蹴り出し側はそのままの方向のカーブだとトレッドの幅端までの溝パスを大きく取れないので、逆にトレッドの幅中心側に中心をもつ有る曲率のカーブとすることで溝パスが大きく取れる。この場合も傾斜主溝の長さを接地長より長くとり得るため直接傾斜溝がトレッドの幅端まで延びて開通することがなくても排水性を損なうことはない。

【0028】それ故ほとんど傾斜主溝にて排水をまかなうことが可能となり、より大きい角度でトレッドの幅端をこえて延びる副溝のネガティブを低く設定することができ、従ってパターンノイズの改良にもなる。

【0029】

【実施例】タイヤの呼びPSR 225/50R16で、トレッド半幅W:100mm、接地長L=120mmの諸元のタイヤについて本発明を次のように適用した。

【0030】

【数1】発明パターンA (図1) :トレッドのネガティブ比N:0.3 %

傾斜主溝のネガティブ比Na=28%

Na/N=93%

Wa:90mm Wb:80mm

Wa/W=90% Wb/W=80%

【0031】

【表1】

※Wa:90mm Wb:80mm

Wa/W=90% Wb/W=80%

【0033】

	溝幅 (mm)	溝角度
右上向き傾斜横断主溝 2	11.5	18°
右上向き傾斜主溝 2	10.5	18°
分岐副溝 3	4	72°
付加副溝 4	3	72°
細溝 3a, 3b, 3c, 3d	0.7	72°

【0034】細溝 3a, 3b, 3c, 3d の円周ピッチは 3a~3b 間 (l_1) > 3b~3c 間 (l_1) > 3c~3d 間 (l_1) であり、 l_1 は接地長 L よりも短い。

* $N_a/N = 79\%$

$W_a : 80\text{mm}$

$W_a/W = 80\%$

【0035】

【数3】発明パターンC (図2) : $N : 28\%$

【0036】

【表3】

$N_a : 22\%$

*

	溝幅 (mm)	溝 角 度
傾斜主溝 2	7 ~ 4	中央 ~ 1/4 ~ 端部 : 15~25~10°
分岐副溝 3	3.5	72°
細溝 3a, 3b, 3c	2	72°

【0037】傾斜主溝 2, 2 は S 字状をなす。細溝 3a, 3b, 3c のピッチは 3a~3b 間 (l_1) > 3b~3c 間 (l_1) であり、 l_1 は接地長 L よりも短い。

※同じに描えて、次のテストを行ったところ、表4に示す成績 (従来パターンを 100 とする指数表示) を得た。

【0039】

【0038】図4に示した従来タイヤは、パターンの違いのみで他の構成は発明パターンC (図2) のタイヤに※

【数4】

テスト条件 : 内圧 2.3 kgf/cm²、荷重実車 2 名乗車相当

ウエットハイプレ : 水深 5 mm のウエット路を、時速 80, 90 Km で

(直線) 過時の接地面の残存面積の計測

ウエットハイプレ : 水深 5 mm の半径 R が 80 m のウエット路を時通過時の

(コーナリング) 限界横 G の計測

パターンノイズ : 直線平滑路を 100 Km/h から惰行したときの車内音
のフィーリング評価

【0040】

★ ★【表4】

	従来パターン	発明パターン A	発明パターン B	発明パターン C
ウェットハイプレ (直線)	100	130	140	150
ウェットハイプレ (コーナリング)	100	110	115	105
パターンノイズ	100	110	105	103
通過騒音	100	120	150	180

【0041】

【発明の効果】本発明によれば高いウェット性能を低ノイズの下で、他の主要機能の犠牲を伴うことなく両立し得るトレッドパターンとしてとくに有用である。

【図面の簡単な説明】

【図1】本発明によるトレッドパターンを例示したトレ*

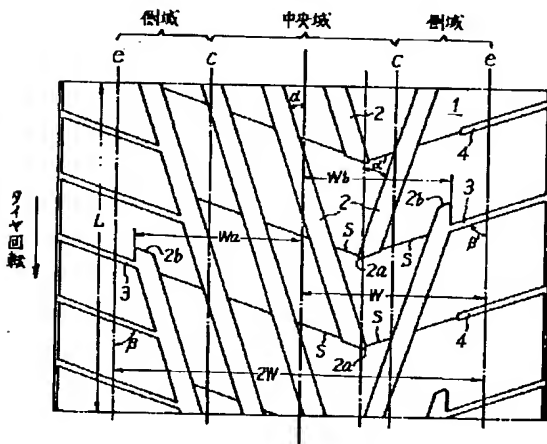
* ッドの要部展開図である。

【図2】本発明によるトレッドパターンを例示したトレッドの要部展開図である。

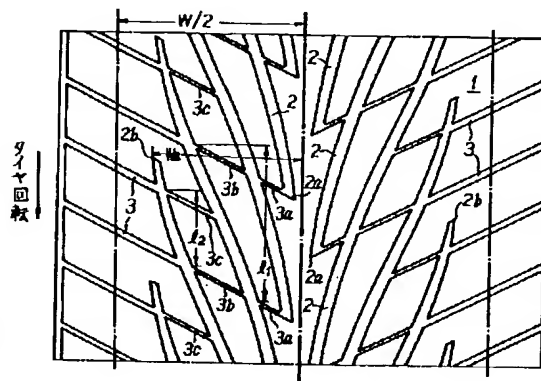
【図3】本発明によるトレッドパターンを例示したトレッドの要部展開図である。

【図4】従来の代表パターンの同様な展開図である。

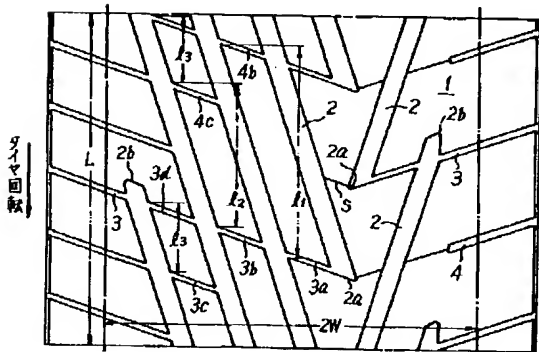
【図1】



【図2】



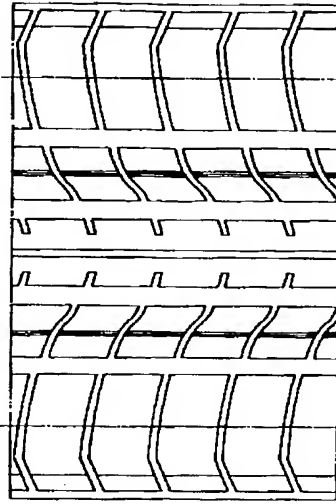
【図3】



(7)

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【図4】



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] wearing on the high-class high performance car which improved until the high movement engine-performance tire, i.e., performance-traverse ability, reached the highest level -- in the pneumatic tire improved so that access may be suited, it is going to propose the pneumatic tire which materialized the radical design about the tread pattern which does not sacrifice main functions, but carries out and is compatible in the high wet engine performance and pattern noise reduction.

[0002]

[Description of the Prior Art] In order to be compatible in an improvement of the wet engine performance and pattern noise reduction, the pattern which combined the straight major groove and the inclination slot on the directivity is common as shown in JP,4-1920,A.

[0003] Moreover, in order to improve hydroplaning-proof nature among wet engine performance in this case, even if it is effective to increase a groove surface product (negative), a noise is as getting worse already being known.

[0004]

[Problem(s) to be Solved by the Invention] The knowledge of wastewater nature becoming good was carried out as a result of experiment examination of artificers by combining the super-inclination slot of the high angle type which in addition to the inclination slot of the usual directivity was expensive for only a pair becoming in the direction of a path of a tire, that is, set the inclination of an inclination slot as the shallow include angle to the equatorial plane of a tire.

[0005] That is, although it becomes advantageous in respect of wet wastewater to combine a super-inclination slot in addition to the usual directivity inclination slot, there is anxiety to which it is hard to expect the pitch variation effectiveness from with the need of setting up pitch die length greatly in order to secure sufficient block rigidity, if the combination is caused how on the other hand, therefore a noise gets worse too.

[0006] Then, it is the purpose of this invention to give the tread pattern which needs to attain low noise-ization, securing the high wet engine performance, and can realize this coexistence advantageously.

[0007]

[Means for Solving the Problem] This invention offers the tread which touches a road surface on the crown section which makes the shape of a toroid and straddles between the sidewalls of a pair. This tread By arrangement of the inclination major groove of a large number aslant prolonged from the central region of a tread in each-other difference to right and left of the tread cross direction at a shallow include angle to the equatorial plane of a tire, respectively In the pneumatic tire which classifies a touch-down land part and changes by these inclination major groove and **** of a tread An inclination major groove has a dead-end terminal the central region of a tread, and near the **** of a tread, respectively. And it grows into the die length and the inclination in which the plurality of the inclination major grooves of above-mentioned a large number surpasses the touch-down length under the dynamic load radius of a tire to constant, and may locate the both sides of a top Noriyuki stop terminal in it over that order. **** of a tread is substantially surpassed near **** of a tread from an inclination major groove top Noriyuki stop terminal thru/or its near. And between sidewall sides Cotton is a pneumatic tire characterized by growing into combination arrangement with the comparatively (narrow) branching minor groove of addressing to one at least prolonged with a loose inclination to the equatorial plane of a tire. It has ***** to which an inclination major groove faces mutually and curves to concave in a convex and width-of-face one end of a tread in the central region of a tread, respectively and which surged loosely here, The inclination major groove which adjoins each other mutually becomes combination arrangement with the branching minor groove addressed to two or more [which classify mutual spacing of each branching minor groove into division into equal parts], It becomes mutual arrangement with the addition minor groove which the branching minor groove in the inclination major groove which adjoins each other mutually isolates those mutual spacing from an inclination major groove, and classifies into division into equal parts mostly, And it is suitable to have the extension to which a branching minor groove intersects an inclination major groove, and extends toward the central region of a tread and which consists of a more nearly narrow-width rill.

[0008] The tread pattern based on this invention was illustrated to drawing 1, and 2 and 3. The basic configuration of a pneumatic tire to which these tread patterns are applied The crown section which makes the shape of a toroid and straddles between the sidewall of a pair, and these It reinforces with the carcass of the radial structure which consists of ply of the code which rolled back and fixed around the bead core laid under the toe of bead of a sidewall section inner circumference edge.

Moreover, are mixed with the surroundings of the crown section by whenever [corniculus] to the flat surface which usually includes the central periphery. It cannot be overemphasized anew that it comes to reinforce the tread offered on the crown section with arrangement of the belt which becomes the two or more layers intersection product layer of a mutual parallel arrangement code, and a reinforcement member may be further arranged suitably by it at the ply edge of a toe of bead, the belt edge of the crown section, or its periphery.

[0009] In each drawing, an inclination major groove 2a and 2b are set to the dead-end terminal, a tread and 2 set 3 to a branching minor groove, drawing 2, and 3 in one in drawing, 3a is the extension of a branching minor groove, and 4 is an addition minor groove in drawing 1 and 3.

[0010] In drawing 1 and 3 the inclination major groove 2 As opposed to making each-other difference to crosswise right and left of a tread 1, respectively, and extending from the central region of a tread 1 (straight) aslant to them at a shallow include angle, to the flat surface (tire equatorial plane) which includes the equator of a tire over both dead-ends edge 2a the central region of a tread 1, and near the **** of a tread 1, and 2b Although a difference is included in the shape of [which is prolonged along with the ***** curve which the inclination major groove 2 faces mutually by (drawing 2), and curves to concave in a convex and width-of-face one end of a tread 1 in the central region of a tread 1 respectively, and which surged loosely] a quirk It is common to the point which becomes the die length in-which the plurality of the inclination major grooves 2 covering a large number surpasses the touch-down length (L: refer to drawing 1) of the tread 1 under the dynamic load radius of a tire to constant by the whole tread 1, and the both sides of top Noriyuki stop terminal 2a and 2b may be locate over that order, and an inclination.

[0011] saying [the central region of a tread 1] here -- one half of the touch-down width of face of a tread 1 (it is called "tread half width" below and W shows) -- further -- about -- it is ** from the tire equator about one half at right and left, respectively -- it is the strip region virtually classified by the shining tread peripheries c and c (refer to drawing 1), and a tread 1 is formed with a lateral area until it results in **** c and c of the tread 1 of the both sides.

[0012] Drawing 1 and in the case of 3, although dead-end terminal 2a of the inclination major groove 2 becomes the unsymmetrical arrangement which inclined toward right-hand side in drawing, it can be considered as the alignment arrangement which faces across a tire equatorial plane as shown in drawing 2. }

[0013] The inclination major groove 2 from dead-end terminal 2b near tread **** e thru/or its near Surpass **** e of a tread 1 substantially and it crosses between sidewall sides. Addressing to at least one prolonged with a loose inclination to the equatorial plane of a tire, drawing 1, and on the left-hand side of 3, addressing to three, On the right-hand side by addressing to one, and drawing 2, right and left have the comparatively narrow-width branching minor groove 3 addressed to two. These branching minor grooves 3 can offer drawing 2 and an extension which consists of the narrow-width rills 3a, 3b, and 3c or 3a, 3b, 3c, and 3d rather than it intersects the adjoining inclination major groove 2 and is extended toward the central region of a tread 1 like 3.

[0014] Carry out to two or more [divide mostly mutual spacing of each branching minor groove 3 equally about the inclination major groove 2 which the branching minor groove 3 adjoins mutually in any case, and classify], and **** is made good at combination arrangement with the inclination major groove 2. On the left-hand side of drawing 1 and 3, it is the example which divided right and left into two equally in three division into equal parts and drawing 2, and is the example which arranged the addition minor groove 4 which drawing 1 and in the case of 2 divides mutual spacing of the branching minor groove 3 on the right-hand side of drawing into two equally, and is isolated from the inclination major groove 2.

[0015] In the place described above, the inclination major groove 2 considers more preferably 30 degrees or less whenever [to the equatorial plane of the tire / shallow tilt-angle] as alternate arrangement at 5-20 degrees at right and left of the cross direction of a tread 1. In addition, what is necessary is just to make it become 5-20 degrees per [in the both sides of a curving point] concavo-convex both curves in the example of drawing 2 by the average of the crossing angle over the equatorial plane of the tire of each tangent in 2 grade equinoctial point of the die length of them. Moreover, to the equatorial plane of a tire, the branching minor groove 3 and the addition minor groove 4 are 30 degrees or more in include angle, and are taken as the arrangement which so does not penetrate the touch-down length L of a tread 1.

[0016] The rills 3a, 3b, and 3c as an extension of the inclination major groove 2, the branching minor groove 3 and the addition minor groove 4, and the branching minor groove 3, or 3d When it says concretely with a narrow flute width in order of the above-mentioned listing, the inclination major groove 2 receives this 5% to 15% of the half width W of a tread 1. The branching minor groove 3 and the addition minor groove 4 To the flute width of the inclination major groove 2, with 20 - 40% of flute width, at least 2mm which closes and is not put together during the touch-down at the time of a tread 1 receiving a dynamic load is made into a minimum, and about Rills 3a, 3b, and 3c or 3d, it is still narrower, and may be 15% - 30% to the flute width of the inclination major groove 2.

[0017] It is **** better ** to prepare by the narrow width of face (about 1mm) which closes SAIPU S extended almost in parallel with the branching minor groove 3 or the addition minor groove 4 during the touch-down of a tread 1, and is put together from dead-end edge 2 located in central region of tread 1 of inclination major groove 2 as thin line showed to drawing 1 and 2 a, and to divide the touch-down land part between the inclination major grooves 2 along with the surroundings of a tread 1.

[0018] The ratio of the sum total area of an inclination major groove [as opposed to **** better ** and a slot gross area in the ratio to the sum of the slot gross area and land part gross area of the negative ratio of the tread 1 by the above-mentioned slot arrangement, i.e., a slot gross area, considering as within the limits of 0.25-0.35] is 0.7. Not turning the bottom is desirable.

[0019]

[Function]

1) In this invention, in order to maintain sufficient wet engine performance, it is common to have an inclination major groove with

directivity and to set a negative ratio to 0.25-0.35.

[0020] 2) For the flow of the water in a tread ground plane, central **** of a tread is [a tread lateral area] the other side to the side at a larger include angle than it in 0 degree - 30 degree front to the tangential direction of a tread. Therefore, it is effective for especially a tread central region in wet wastewater nature to have the inclination major groove of a high angle type with a quite small tilt angle. Moreover, the bad influence to a pattern noise has few impact components at the time of touch-down few because of a high angle type.

[0021] 3) And it becomes yes, possible [the inclination major groove of an angle type] to achieve the wastewater function in the tread which changes to a straight major groove which meets the conventional tread periphery by extending continuously toward a lateral area from the central region of a tread, and securing sufficient slot volume.

[0022] 4) At this time, it is desirable in wet wastewater nature for the ratio to the slot gross area in the whole tread of the inclination major groove groove surface product sum total to secure more than 0.7 %.

[0023] 5) Yes, since wastewater sufficient because begin to kick the inclination major groove of an angle type from treading in the ground plane of a tread and it is open for free passage over until is performed, At least in a ground plane, existence of two or more inclination major grooves is required for constant. Wa is made into 70% or more of the tread half width W so that the wastewater in a ground plane may be covered from ** from the tire equatorial plane of dead-end terminal 2b of the inclination major groove of width-of-face one end of a tread, without carrying out opening to **** of a tread with the include angle.

[0024] 6) wastewater by the wet tread at the time of rectilinear propagation -- being related -- yes, although it is about 10 minutes only in the inclination major groove of an angle type, a cornering wastewater function is satisfied with the need of shifting the frequency of an air column resonance for a passage noise reduction -- as -- a pitch [at least] shorter than touch-down length -- yes, prepare low-angle narrow-width the branching minor groove and addition minor groove which intersect the inclination major groove of an angle type.

[0025] 7) At this time, since an impact chance will increase if each minor groove is too numerous, and a pattern noise gets worse, it is so desirable that the central region of the tread with large effect in a noise enlarges a crossover pitch and goes to **** to make a pitch fine.

[0026] 8) Moreover, it is also required for a pattern noise to tend to get worse, since pitch length will be extended and the variation effectiveness will be hard to be acquired, if spacing of adjoining land parts is a setup which can secure sufficient block rigidity, and to reduce the impact component by both minor grooves. Therefore, it is thin in the flute width of the narrow-width branching minor groove of a low angle, and it is good to limit to 20 - 40% of flute width of the flute width of the inclination major groove of a high angle type so that an impact component may be stopped.

[0027] 9) Yes, although the curve prolonged in the shape of abbreviation for S characters is sufficient as the inclination major groove of an angle type as drawing 2 was already described, it is an area important for high pre nature in the center of the die length of an inclination major groove to a treading-in side. Since the large slot pass to **** of a tread cannot be taken if it begins to kick and a side is the curve of a direction as it is while the direction of an elementary stream loosely curved towards the side in accordance with the flow of the water in a ground plane from the central region of a tread is desirable Conversely, large slot pass can be taken by considering as the curve of the existing curvature which has a core in the width-of-face core side of a tread. Wastewater nature is not spoiled, even if a direct inclination slot extends and is not opened for traffic to **** of a tread, since the die length of an inclination major groove longer than touch-down length can be taken also in this case.

[0028] So, it becomes possible to almost provide wastewater with an inclination major groove, and the negative of the minor groove which surpasses **** of a tread and is prolonged at a larger include angle can be set up low, therefore it also becomes amelioration of a pattern noise.

[0029]

[Example] Call PSR of a tire By 225 / 50R16, this invention was applied as follows about the tire of the item of the tread half width of W:100mm, and L= 120mm of touch-down length.

[0030]

[Equation 1] invention pattern A(drawing 1): -- the negative ratio of the negative ratio N:0.3 % inclination major groove of a tread -- Na=28%Na/N=93%Wa:90mm Wb:80 mmWa/W=90% Wb/W= -- 80% [0031]

[Table 1]

	溝幅 (mm)	溝角度
右上向き傾斜主溝 2	11.5	18°
右上向き傾斜主溝 2	10.5	18°
分岐副溝 3	4	72°
付加副溝 4	0.7	72°

[0032]

[Equation 2] Invention Pattern B(drawing 3): N 32.5 %Na:28%Na/N=86%Wa:90mm Wb:80 mmWa/W=90%



Wb/W=80%[0033]

[Table 2]

	溝幅 (mm)	溝角度
右上向き傾斜横断主溝 2	11.5	18°
右上向き傾斜主溝 2	10.5	18°
分岐副溝 3	4	72°
付加副溝 4	3	72°
細溝 3a, 3b, 3c, 3d	0.7	72°

[0034] a Rills [3a, 3b, 3c, and 3d] circular pitch -- 3a-3b -- for >3c-3d between between (11) >3b-3c (11) (13) -- it is -- 11 the touch-down length L -- short paddle.

[0035]

[Equation 3] Invention Pattern C(drawing 2): N:28%Na:22%Na/N=79%Wa:80 mmWa/W=80%[0036]

[Table 3]

	溝幅 (mm)	溝 角 度
傾斜主溝 2	7 ~ 4	中央~1/4 ~端部 : 15~25~10°
分岐副溝 3	3.5	72 °
細溝 3a, 3b, 3c	2	72 °

[0037] The inclination major grooves 2 and 2 make the shape of S character. The pitch of Rills 3a, 3b, and 3c is between >3between 3a - 3b (11) b-3c (11), and is 11. It is a short paddle from the touch-down length L.

[0038] When the configuration of the others [tire] only in the difference in a pattern conventionally shown in drawing 4 was arranged similarly to the tire of the invention pattern C (drawing 2) and the next test was performed, the results (characteristic display which sets a pattern to 100 conventionally) shown in Table 4 were acquired.

[0039]

[Equation 4]

テスト条件 : 内圧2.3 kgW /cm²、荷重実車2名乗車相当

ウエットハイプレ : 水深5mmのウエット路を、時速80, 90Kmで

(直線) 過時の接地面の残存面積の計測

ウエットハイプレ : 水深5mmの半径Rが80mのウエット路を時通過時の

(コーナリング) 限界横Gの計測

パターンノイズ : 直線平滑路を100Km/hから惰行したときの車内音
のフィーリング評価

[0040]

[Table 4]

	従来パターン	発明パターン A	発明パターン B	発明パターン C
ウェットハイプレ (直線)	100	130	140	150
ウェットハイプレ (コーナリング)	100	110	115	105
パターンノイズ	100	110	105	103
通過騒音	100	120	150	180

[0041]

[Effect of the Invention] According to this invention, it is useful especially as a tread pattern which may be compatible in the high wet engine performance, without being accompanied by the sacrifice of other main functions under a low noise.

[Translation done.]

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CLAIMS

[Claim(s)]

[Claim 1] The tread which touches a road surface is offered on the crown section which makes the shape of a toroid and straddles between the sidewalls of a pair. This tread By arrangement of the inclination major groove of a large number aslant prolonged from the central region of a tread in each-other difference to right and left of the tread cross direction at a shallow include angle to the equatorial plane of a tire, respectively In the pneumatic tire which classifies a touch-down land part and changes by these inclination major groove and **** of a tread An inclination major groove has a dead-end terminal the central region of a tread, and near the **** of a tread, respectively. And it grows into the dic length and the inclination in which the plurality of the inclination major grooves of above-mentioned a large number surpasses the touch-down length under the dynamic load radius of a tire to constant, and may locate the both sides of a top Noriyuki stop terminal in it over that order. **** of a tread is substantially surpassed near **** of a tread from an inclination major groove top Noriyuki stop terminal thru/or its near. And between sidewall sides Cotton is a pneumatic tire characterized by growing into combination arrangement with the comparatively narrow branching minor groove of addressing to one at least prolonged with a loose inclination to the equatorial plane of a tire.

[Claim 2] The pneumatic tire with which an inclination major groove faces mutually and curves to concave in a convex and width-of-face one end of a tread in the central region of a tread, respectively and which was indicated to claim 1 with ***** which surged loosely.

[Claim 3] The pneumatic tire with which the inclination major groove which adjoins each other mutually indicated mutual spacing of each branching minor groove to claim 1 which becomes combination arrangement with the branching minor groove addressed to two or more [which are mostly classified into division into equal parts], or 2.

[Claim 4] The pneumatic tire indicated to claims 1 and 2 which become mutual arrangement with the addition minor groove which the branching minor groove in the inclination major groove which adjoins each other mutually isolates those mutual spacing from an inclination major groove, and classifies into division into equal parts, or 3.

[Claim 5] The pneumatic tire indicated to claims 1, 2, and 3 with the extension which consists of a more nearly narrow-width rill to which a branching minor groove intersects an inclination major groove, and extends toward the central region of a tread, or 4.

[Claim 6] The pneumatic tire indicated to claim 5 which becomes such a smaller pitch array that a branching minor groove goes to **** from the central region of a tread also including the extension.

[Translation done.]

REMARKS/ARGUMENTS

Applicants submit this Amendment in reply to the Office Action mailed March 25, 2004.

Applicants amend claims 29 and 58. Claims 39 and 58 have been amended to recite “wherein the equatorial groove portion of each transversal groove has a uniform width” and “wherein the shoulder groove portion of each transversal groove has at least a portion having a width smaller than the width of the equatorial groove portion” in order to better define the invention. Before entry of this Amendment, claims 39 –62 were pending in this application. After entry of this Amendment, claims 39 –62 are pending in this application.

The originally-filed specification, claims, abstract, and drawings fully support the amendments to claims 39 and 58. For example, Figure 2 shows transversal grooves 15 having a reduced width or constriction 20.

Examiner Interview

Applicants thank the Examiner for meeting with Applicants’ representative on June 22, 2004. During the interview, the Applicants’ representative and the Examiner discussed claims 39 -62 and the prior art of record. No agreement was reached as to whether any claims would be allowable based on the proposed amendment.

Claim Rejections Under 35 U.S.C. § 103(a)

In the Office Action dated March 25, 2004, the Examiner rejected claims 39-48, 50-53, and 55-58 under 35 U.S.C. § 103 (a) as being unpatentable over U.S. Patent No. 2,104,532 to Sommer (“Sommer”) in view of Great Britain Patent No. 2,224,472 (“Great Britain ‘472”), alleged admitted prior art (specification page 3, lines 1-5, “AAPA”) or U.S. Patent No. 1,996,418 to Hargraves (“Hargraves”). The Examiner also rejected claim 49 under 35 U.S.C. § 103 (a) as

Interview Record OK
JN 11-12-04